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(54) Title: ENHANCED THERMAL INACTIVATION OF PATHOGEN IN A NUTRIMENT BY ACIDULANT

(57) Abstract: A method for increasing the rate of thermal inactivation of a pathogen in a nutriment by contacting the nutriment with an acidulant. A method for extending case shelf-life of a nutriment by contacting the nutriment with an acidulant. The acidulant can be: (a) an acidic, or low pH, solution of sparingly-soluble Group II A complexes ("AGIIIS"); (b) a highly acidic metalated mixture of inorganic acid ("HAMMIA"); (c) a highly acidic metalated organic acid ("HAMO"); (d) a mixture of the above; or (e) an adduct of each of the above. The nutriment can be an animal product, a plant product, a beverage, or a mixture thereof.

What is claimed is:

1. A method for increasing rate of thermal inactivation of a pathogen in a nutriment, comprising:
 - 5 contacting the nutriment with an acidulant.
2. The method of claim 1, wherein the acidulant comprises: (a) an acidic, or low pH, solution of sparingly-soluble Group IIA complexes ("AGIIS"); (b) a highly acidic metalated mixture of inorganic acid ("HAMMIA"); (c) a highly acidic metalated organic acid ("HAMO"); (d) a mixture of the above; or (e) an adduct of each of the above.
 - 10
3. The method of claim 1, wherein the nutriment comprises an animal product, a plant product, a beverage, or a mixture thereof.
4. A method for increasing rate of thermal inactivation of a pathogen in a nutriment, comprising:
 - 15 contacting the nutriment with a solution or suspension of an acidic sparingly-soluble Group IIA complex ("AGIIS"), wherein the AGIIS is isolated from a mixture comprising a mineral acid and a Group IIA hydroxide, or a Group IIA salt of a dibasic acid, or a mixture of the two.
5. The method of claim 4, wherein the Group IIA hydroxide comprises calcium hydroxide, the mineral acid comprises sulfuric acid, and the Group IIA salt of a dibasic acid comprises calcium sulfate.
 - 20
6. The method of claim 4, further comprising adding an additive to the AGIIS.
7. The method of claim 6, wherein the additive comprises an alcohol.
- 25 8. The method of claim 6, wherein the additive comprises an organic acid or an periodic acid.

9. The method of claim 6, wherein the additive comprises a surfactant.

10. The method of claim 4, wherein the nutrient comprises an animal product, a plant product, a beverage, or a mixture thereof.

11. The method of claim 4, wherein the nutrient comprises a meat product.

12. A method for increasing rate of thermal inactivation of pathogen in a nutrient comprising:

10 contacting a solution or suspension of an acidic sparingly-soluble Group IIA complex ("AGIIS") with a carrier to give a constituted carrier, wherein the AGIIS is isolated from a mixture comprising a mineral acid and a Group IIA hydroxide, or a Group IIA salt of a dibasic acid, or a mixture of the two; and blending the constituted carrier with the nutrient.

13. A method for increasing rate of thermal inactivation of pathogen in a nutrient comprising:

15 contacting a solution or suspension of an acidic sparingly-soluble Group IIA complex ("AGIIS") with an additive and with a carrier to give a constituted carrier having the additive, wherein the AGIIS is isolated from a mixture comprising a mineral acid and a Group IIA hydroxide, or a Group IIA salt of a dibasic acid, or a mixture of the two; and

20 blending the nutrient with the constituted carrier having the additive.

14. A method for increasing rate of thermal inactivation of a pathogen in a nutrient comprising:

25 contacting a solution or suspension of a highly acidic metalated organic acid ("HAMO") with the nutrient, wherein the solution or suspension of the HAMO is prepared by mixing ingredients comprising:

at least one regenerating acid having a first number of equivalents;
at least one metal base having a second number of equivalents; and
at least one organic acid; wherein the first number or equivalents of the

22. A method for increasing rate of thermal inactivation of a pathogen in a nutrient, comprising:

5 contacting the nutrient with a solution or suspension of a highly acidic metalated mixture of inorganic acid ("HAMMIA") having an acidic pH, wherein the HAMMIA is prepared by mixing ingredients comprising:

a salt of phosphoric acid; and

10 a preformed, or in-situ generated, solution or suspension of an acidic sparingly-soluble Group IIA complex ("AGIIS"), wherein the solution or suspension of AGIIS is in an amount in excess of the amount required to completely convert the salt of phosphoric acid to phosphoric acid and sufficient to render the acidic pH of the HAMMIA to be less than about 2.

23. The method of claim 22, wherein the solution or suspension of the AGIIS is isolated from a mixture comprising a mineral acid and a Group IIA hydroxide, or a Group IIA salt of a dibasic acid, or a mixture of the two.

15 24. The method of claim 22, wherein the Group IIA hydroxide comprises calcium hydroxide, the mineral acid comprises sulfuric acid and the Group IIA salt of a dibasic acid comprises calcium sulfate.

25. The method of claim 22, wherein the salt of phosphoric acid comprises a divalent metal salt of phosphoric acid.

20 26. The method of claim 22, wherein the divalent metal comprises an alkali earth metal or a metal of first transition series.

27. The method of claim 22, wherein the salt of phosphoric acid comprises a mono-valent metal salt of phosphoric acid.

25 28. The method of claim 22, wherein the mono-valent metal comprises an alkali metal.

29. The method of claim 22, further comprising adding an additive to the HAMMIA.